Experimental Double-Differential Light-Ion Production Cross Sections for Silicon at 95 MeV Neutrons

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The radiation effects induced by terrestrial cosmic rays in microelectronics, on board aircrafts as well as at sea level, have recently attracted much attention. The most important particle radiation is due to spallation neutrons, created in the atmosphere by cosmic-ray protons. When, e.g., an electronic memory circuit is exposed to neutron radiation, charged particles can be produced in a nuclear reaction. The charge released by ionization can cause a flip of the memory content in a bit, which is called a single-event upset (SEU). This induces no hardware damage to the circuit, but unwanted re-programming of memories, CPUs, etc., can have consequences for the reliability, and ultimately also for the safety of the system.

Data on energy and angular distribution of the secondary particles produced from neutron-silicon nuclei are essential input for analyses and calculation of SEU rate. In this work, double-differential cross sections of inclusive light-ion (p, d, t, ^{3}He and α) production in silicon, induced by 95 MeV neutrons, are presented. Angular distributions are measured at eight laboratory angles from 20° to 160° in steps of 20°. Deduced energy-differential, angle-differential and total cross sections are reported as well. Experimental cross sections are compared to theoretical reaction model calculations and existing experimental data in the literature.

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